



# Techniques for Time Domain Astronomy

Rob Seaman, NOAO

Roy Williams, Caltech



# Hey Howdy Hey!

- *“All strange and terrible events are welcome”*  
– Shakespeare, *Antony and Cleopatra*
- Focus today on closing the event loop



# Agenda

- Setting the scene – *R. Seaman*
- SkyAlert & VOEvent – *R. Williams*
- The time domain and WWT – *J. Fay*
- Transient infrastructure for SVOM – *J-P Le Fèvre*
- 3 things your robot should know – *R. Seaman*
- Authoring a VOEvent stream – *R. Williams*
- Spirited discussion throughout



# Broader discussion

IAU Symposium 285

*New Horizons in Time Domain Astronomy*

Chairs: Griffin & Hanisch

Oxford, UK – 19-23 Sep 2011

<http://www.physics.ox.ac.uk/timedomainconf>

## Messaging you need to know about

ASAS ATEL

GCN

OGLE

TALONS

IAUC

SNEWS

CBAT

GMAN

AAVSO

EROS

NOVALERT

EWS

VSNET

AstroAlert

SN Neutrino Alert Net





# Event transport

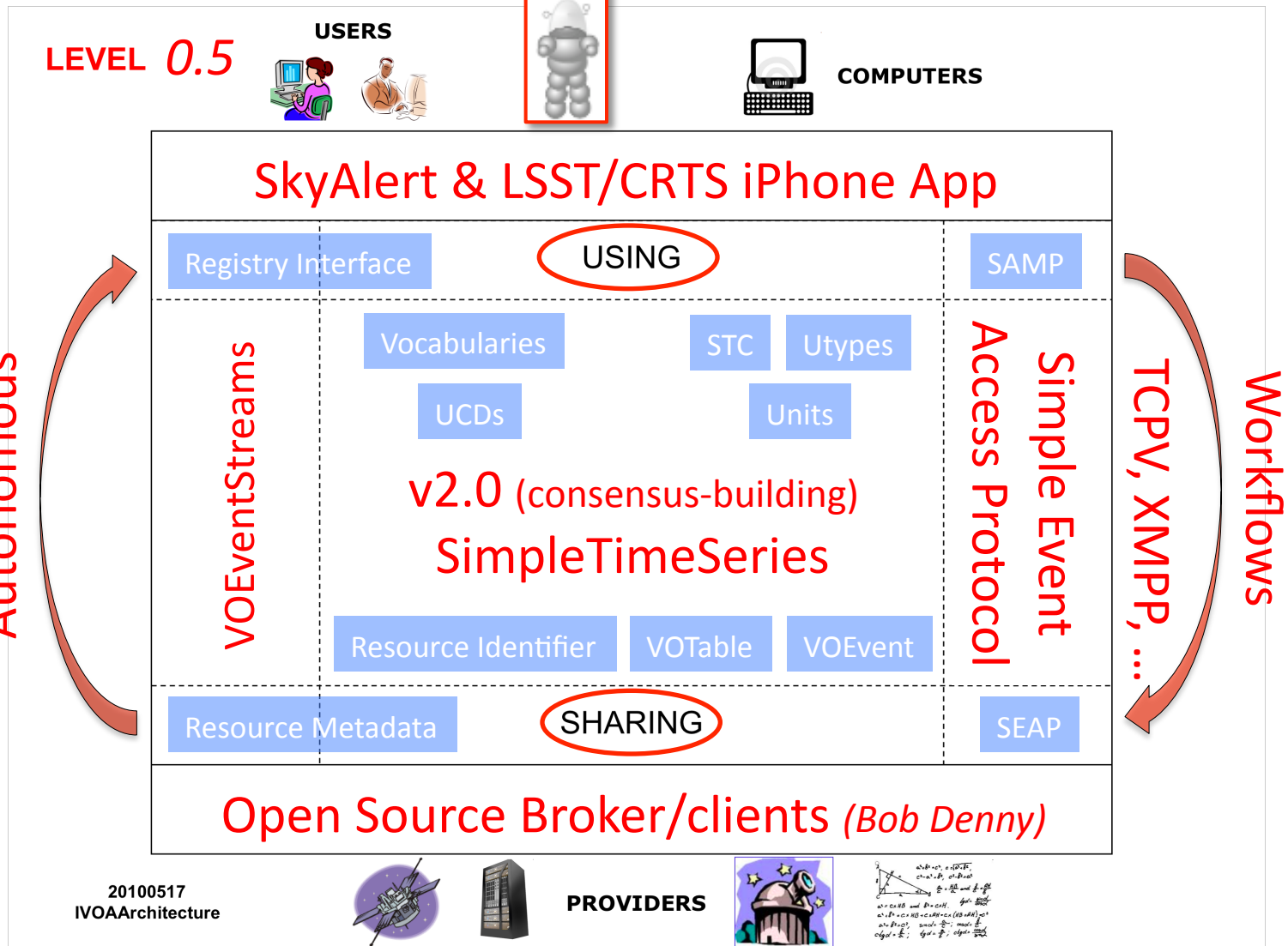
- Transport protocol



# Event transport

- Transport protocol(s)
- Push / Pull technologies
- Publish / Subscribe paradigm
- Brokers
- Bridging networks
- Repositories
- SEAP
- VOEventNet, VO-GCN, SkyAlert, ...

# VOEvent Architecture





# VOEvent

- Who – author's provenance
- What
- Where
- When
- How
- Why



# VOEvent

- Who – author's provenance
- **What – empirical measurements**
- Where
- When
- How
- Why



# VOEvent

- Who – author's provenance
- What – empirical measurements
- Where – targeting in space
- When – constraints in time
- How
- Why



# VOEvent

- Who – author's provenance
- What – empirical measurements
- WhereWhen – targeting in spacetime
- How
- Why



# VOEvent

- Who – author's provenance
- What – empirical measurements
- WhereWhen – targeting in spacetime
- How – instrumental signature
- Why



# VOEvent

- Who – author's provenance
- What – empirical measurements
- WhereWhen – targeting in spacetime
- How – instrumental signature
- **Why – scientific characterization**



# VOEvent is XML

```
<Why importance="1.0" expires="1574-05-11T12:00:00">
  <Inference probability="1.0">
    <Name>Tycho's Stella Nova</Name>
    <Concept>stars.supernova.la</Concept>
  </Inference>
  <Inference probability="1.0" relation="associated">
    <Name>3C 10</Name>
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**Engineering for empirical workflows**



# Follow-up with citations

<Citations>

<EventIVORN cite="retraction">

ivo://uraniborg.hven#1572-11-11/0001

</EventIVORN>

<Description>Oops!</Description>

</Citations>



# Follow-up with citations

- Use citations for:
  - Chaining follow-up observations
  - Retracting events
  - Splitting streams of events
  - Joining streams of events
- Use <references> for external content



# VOEvent status

- Numerous authors of event streams
- Varied projects following up, diverse purposes
  - Robotic
  - ToO
- A growing, evolving network
- VOEvent v2.0 working draft released
- SEAP pending v2.0



# Next speaker

- **SkyAlert & VOEvent** – *R. Williams*
- The time domain and WWT – *J. Fay*
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